Confirmation No. 6408

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Meunier-Beillard *et al.*	Examiner:	Khiem Nguyen
Serial No.:	10/550,853	Group Art Unit:	2823
Filed:	September 22, 2005	Docket No.:	NL030357 US1
Title:	METHOD OF EPITAXIAL DEPOSITION OF AN N-DOPED SILICON LAYER		

APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Customer No.
65913

Dear Sir:

This Appeal Brief is submitted pursuant to 37 C.F.R. §41.37, in support of the Notice of Appeal filed December 13, 2007 and in response to the rejections of claims 1-17 as set forth in the Final Office Action dated September 17, 2007, and in further response to the Advisory Action dated November 7, 2007.

Please charge Deposit Account number 50-0996 (NXPS.265PA) $510.00 for filing this brief in support of an appeal as set forth in 37 C.F.R. §1.17(c). If necessary, authority is given to charge/credit Deposit Account 50-0996 (NXPS.265PA) additional fees/overages in support of this filing.

I. Real Party In Interest

The real party in interest is NXP Semiconductors. The application is presently assigned of record, at reel/frame nos. 017816/0820 to Koninklijke Philips Electronics, N.V., headquartered in Eindhoven, the Netherlands. We have been authorized by both the assignee of record and NXP Semiconductors to convey herein that the entire right, title and interest of the instant patent application have been transferred to NXP Semiconductors.

II. Related Appeals and Interferences

While Appellant is aware of other pending applications owned by the above-identified Assignee, Appellant is unaware of any related appeals, interferences or judicial proceedings that would have a bearing on the Board's decision in the instant appeal.

III. Status of Claims

Claims 1-17 stand rejected. Accordingly, claims 1-17 are presented for appeal. A complete listing of the claims under appeal is provided in an Appendix to this Brief.

IV. Status of Amendments

No amendments have been filed subsequent to the Final Office Action dated September 17, 2007.

V. Summary of Claimed Subject Matter

Commensurate with independent claim 1, an example embodiment of the present invention is directed to a method of manufacturing a semiconductor device with a semiconductor body (*see, e.g.*, Figure 7, element 1) comprising: silicon provided with an n-type doped semiconductor region (*see, e.g.*, Figure 7, element 2) comprising silicon formed by an epitaxial deposition process, wherein the epitaxial deposition process of the n-type region is performed by positioning the semiconductor body in an epitaxial reactor and introducing in the reactor a first gas stream comprising a carrier gas and further gas streams comprising a gaseous compound comprising silicon and a gaseous compound comprising an element from the fifth column of the periodic system of elements (*see, e.g.*, page 2, lines 19-

22), while heating the semiconductor body to a growth temperature and using an inert gas as the carrier gas, characterized in that for the gaseous compound comprising silicon a mixture is chosen of a first gaseous silicon compound which is free of chlorine, and a second gaseous silicon compound comprising chlorine (*see, e.g.*, page 2, lines 7-18).

VI. Grounds of Rejection to be Reviewed Upon Appeal

A. Claims 1-5 and 7-17 stand rejected under 35 U.S.C. § 102(b) over Park *et al.* (U.S. Pat. No. 6,391,749).

B. Claim 6 stands rejected under 35 U.S.C. § 103(a) over Park *et al.* (U.S. Pat. No. 6,391,749).

VII. Argument

Appellant respectfully submits that each of the rejections must be reversed because the Park reference makes no mention of using an inert gas as a carrier gas and because the rejections rely upon the Examiner's erroneous assertion that hydrogen is an inert gas.

A. The 35 U.S.C. § 102(b) Rejection of Claims 1-5 And 7-17 Over Park (U.S. Patent No. 6,391,749) is Improper Because the Cited Portions of Park do Not Correspond to the Claimed Invention

1. The § 102(b) Rejection Of Claims 1-5 And 7-17 is Improper Because the Cited Portions of Park do Not Correspond to the Claimed Invention

The cited portions of the Park reference do not teach aspects of the claimed invention directed to using an inert gas as the carrier gas. The Examiner improperly asserts that Park teaches using hydrogen as a carrier gas. In contrast, the cited portions of Park teach that hydrogen is used as a reducing gas that is introduced separately from the source gas, and not as a carrier gas (*see, e.g.,* Col. 5:18-20). Moreover, a word search of the Park reference reveals that Park fails to make any mention of a carrier gas or an inert gas. The Examiner also erroneously asserts that hydrogen is an inert gas. The Examiner's assertion is directly contradicted by the Park reference which introduces the hydrogen gas for the express purpose of reacting with the passivation layer to remove the passivation layer on the semiconductor

layer. *See, e.g.,* Col. 4:33-37. As such, Park teaches the use of hydrogen for its highly reactive nature. Irrespective of Park, Appellant submits that it would be readily apparent to the skilled artisan that hydrogen gas, which is highly reactive, is not as inert gas. The Examiner responded to Appellant's arguments regarding these issues by citing Park at Col. 3:48-59, which discusses source gases; however, this portion of Park makes no mention of a carrier gas or hydrogen. The Examiner also responded to Appellant's arguments by citing Park at Col. 5:11-28, which teaches using hydrogen as a reducing gas; however, this portion of Park makes no mention of a carrier gas or of using hydrogen as a carrier gas.

Appellant notes that, in the Advisory Action, the Examiner cites to Appellant's specification in asserting that using an inert gas such as helium as a carrier gas is well known. Appellant notes that this would appear to constitute new grounds of rejection and therefore should not form part of this appeal. Appellant submits that the Examiner's new attempt to rely upon Appellant's disclosure appears to be an admission by the Examiner of Park's deficiencies regarding using an inert gas as the carrier gas. The § 102(b) rejection of claims 1-5 and 7-17 that is being appealed is based upon the Park reference alone, which does not teach using an inert gas as a carrier gas. Moreover, the Examiner has not proposed any hypothetical modification of Park or presented any reason why the skilled artisan would modify Park, which does not even mention a carrier gas or an inert gas. Appellant submits that the Examiner's assertion that using helium as a carrier gas is well known is irrelevant to the rejections, which rely upon the Park reference.

In view of the above, the cited portions of the Park reference do not teach using an inert gas as the carrier gas. Accordingly, the § 102(b) rejection of claims 1-5 and 7-17 is improper and should be reversed.

In addition, the cited portions of the Park reference do not teach aspects of the claimed invention directed to the gaseous silicon compound being a mixture of a first gaseous silicon compound which is free of chlorine, and a second gaseous silicon compound which includes chlorine. The Examiner improperly asserts that Park teaches using such a mixture as a source gas. In actuality, the cited portions of Park teach using silane (SiH_4) gas, disilane (Si_2H_6), or diclorosilane (SiH_2Cl_2) as the source gas (*i.e.,* one of these gases is used as the source gas). *See, e.g.,* Col. 3:38-43. Thus, Park teaches using either a silicon gas that

does not contain chlorine or using a silicon gas that does contain chlorine; however Park does not teach using a mixture of these two silicon gases as a source gas. The Examiner responded to Appellant's arguments regarding this issue by citing Park at Col. 3:48-59, which teaches using a silicon source gas in combination with a germanium source gas; however, this portion of Park does not mention the use of any mixture of silicon gases.

In view of the above, the cited portions of the Park reference do not teach using a mixture of a silicon gas that does not contain chlorine and a silicon gas that does contain chlorine. Accordingly, the § 102(b) rejection of claims 1-5 and 7-17 is improper and should be reversed.

2. The § 102(b) Rejection Of Claim 8 is Improper Because the Cited Portions of Park do Not Correspond to the Claimed Invention

The cited portions of the Park reference do not teach aspects of the claimed invention directed to replacing the inert carrier gas with a carrier gas which includes hydrogen. As discussed above in relation to the § 102(b) rejection of claim 1, the cited portions of Park teach using hydrogen as a reducing gas to remove the passivation layer, not as a carrier gas and certainly not as an inert carrier gas. *See, e.g.,* Col. 4:31-38 and Col. 5:18-20. The Park reference further teaches that during period T3 when the reducing gas is being introduced into the chamber, the source gas is not being injected into the chamber. *See, e.g.,* Figure 1 and Col. 3:60-62. Appellant notes that (as discussed above) the Park reference makes no mention of a carrier gas. Thus, Park does not teach switching from using an inert gas as the carrier gas to using hydrogen as the carrier gas as asserted by the Examiner.

Moreover, the Examiner, in the Advisory Action, is apparently improperly relying upon Appellant's specification, which teaches the desirability of switching from using an inert gas as the carrier gas to using hydrogen as the carrier gas, to somehow assert that Park teaches switching carrier gases. *See, e.g.,* lines 12-18 of the Continuation Sheet. However, since Park does not teach any such switching between carrier gases, Appellant submits that the benefits discussed in Appellant's specification are irrelevant to the teachings of Park. Appellant further submits that the Examiner's citation to Appellant's specification in no way addresses the deficiencies of the Park reference. Appellant notes that basing a rejection upon

Appellant's specification would be impermissible hindsight reconstruction. *See, e.g.,* M.P.E.P. § 2142.

In view of the above, the § 102(b) rejection of claim 8 is improper and should be reversed.

3. The § 102(b) Rejection Of Claim 9 is Improper Because the Cited Portions of Park do Not Correspond to the Claimed Invention

The cited portions of the Park reference do not teach aspects of the claimed invention directed to three time periods in which the carrier gas is switched from an inert gas in period one to hydrogen in period two and back to the inert gas in period three. The cited portions of the Park reference teach injecting a source gas during period T1, stopping the source gas and injecting an etching gas (*i.e.,* a highly reactive gas such as chlorine gas) during period T2, and stopping the etching gas and injecting a reducing gas (*e.g.,* hydrogen) to remove the chlorine layer during period T3. *See, e.g.,* Figure 1 and Col. 3:60 to Col. 4:37. Thus, the cited portions of the Park reference do not teach any corresponding use of different types of carrier gases during different time periods as asserted by the Examiner. Accordingly, the § 102(b) rejection of claim 9 is improper and should be reversed.

4. The § 102(b) Rejection Of Claim 9 is Improper Because the Cited Portions of Park do Not Correspond to the Claimed Invention

The cited portions of the Park reference do not teach aspects of the claimed invention directed to using nitrogen as the carrier gas. The cited portions of Park do not mention using nitrogen in any capacity. *See, e.g.,* Col. 5:11-28. Moreover, a word search of the Park reference fails to identify any mention of the word nitrogen or any mention of a carrier gas. Thus, Park does not teach using nitrogen as the carrier gas as asserted by the Examiner. Accordingly, the § 102(b) rejection of claim 13 is improper and should be reversed.

B. The 35 U.S.C. § 103(a) Rejection of Claim 6 Over Park (U.S. Patent No. 6,391,749) is Improper Because the Cited Portions of Park do Not Correspond to the Claimed Invention

The cited portions of the Park reference fail to correspond to the claimed invention as discussed above in relation to the § 102(b) rejection of claim 1. In at least this regard, the § 103(a) rejection of claim 6 is improper because claim 6 depends from claim 1. Accordingly, the § 103(a) rejection of claim 6 is improper and should be reversed.

VIII. Conclusion

In view of the above, Appellant submits that the rejection of claims 1-17 are improper. Appellant therefore requests reversal of the rejections as applied to the appealed claims and allowance of the entire application.

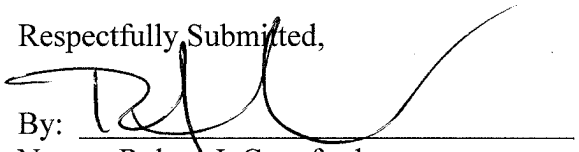
Authority to charge the undersigned's deposit account was provided on the first page of this brief.

Please direct all correspondence to:

Corporate Patent Counsel
NXP Intellectual Property & Standards
1109 McKay Drive; Mail Stop SJ41
San Jose, CA 95131

CUSTOMER NO. 65913

Respectfully Submitted,



By: _____
Name: Robert J. Crawford
Reg. No.: 32,122
Name: Peter S. Zawilski
Reg. No.: 43,305
Tel: 651 686-6633 Ext. 2300
(NXPS.265PA)

APPENDIX OF CLAIMS INVOLVED IN THE APPEAL
(S/N 10/550,853)

1. Method of manufacturing a semiconductor device with a semiconductor body comprising silicon provided with an n-type doped semiconductor region comprising silicon formed by an epitaxial deposition process, wherein

the epitaxial deposition process of the n-type region is performed by positioning the semiconductor body in an epitaxial reactor and

introducing in the reactor a first gas stream comprising a carrier gas and further gas streams comprising a gaseous compound comprising silicon and a gaseous compound comprising an element from the fifth column of the periodic system of elements, while heating the semiconductor body to a growth temperature (Tg) and using an inert gas as the carrier gas, characterized in that for the gaseous compound comprising silicon a mixture is chosen of a first gaseous silicon compound which is free of chlorine and a second gaseous silicon compound comprising chlorine.

2. Method according to claim 1, characterized in that the first gaseous silicon compound silane is chosen and for the second gaseous silicon compound dichlorosilane is chosen.

3. Method according to claim 1, characterized in that for the gaseous compound comprising a V-element, phosphine is chosen.

4. Method according to claim 1,characterized in that for the growth temperature (Tg) a temperature in the range between 500 °C and 600 °C is chosen.

5. Method according to claim 1, characterized in that the epitaxial deposition process is performed at reduced pressure (P).

6. Method according to claim 5, characterized in that a pressure (P) is chosen between 120 and 160 Torr.

7. Method according to claim 1, characterized in that for the semiconductor device a MOSFET device is chosen and the semiconductor region is formed as a source or drain of the MOSFET device.

8. Method according to claim 1, characterized in that the after the growth of the n-type semiconductor region comprising silicon the deposition process is continued with the growth of a further semiconductor region comprising a lower n-type doping than the semiconductor region or comprising a p-type doping and in that at least between the growth of the semiconductor region and the growth of the further semiconductor region, the inert carrier gas is replaced by a carrier gas comprising hydrogen.

9. Method according to claim 8, characterized in that after growth of the semiconductor region, the carrier gas of an inert gas is maintained in a first short period of a cycle of three short periods, the carrier gas is replaced by hydrogen during the second short period and the carrier gas is switched back to the inert gas during the third short period in which the deposition process is continued but without the presence of the gaseous compound of the V-element.

10. Method according to claim 9, characterized in that the cycle of three periods is repeated a number of times.

11. Method according to claim 8, characterized in that during the deposition of the further semiconductor region, the gas stream of the gaseous compound with the V-element is chosen to be zero and replaced by another gas stream comprising a gaseous compound comprising an element of the third column of the periodic system of the elements, resulting in a device comprising a p-type further semiconductor region on top of the n-type semiconductor region.

12. Method according to claim 11, characterized in that for the semiconductor device a pnp bipolar transistor is chosen of which the n-type base region is formed by the n-type

semiconductor region and the p-type emitter regions is formed by the further semiconductor region .

13. Method according to claim 1, characterized in that nitrogen is chosen as the inert gas.

14. Method according to claim 1, characterized in that the semiconductor region or the further semiconductor region are formed as a mixed crystal of silicon and germanium by leading a yet another gas stream to the reactor comprising a gaseous compound of germanium.

15. Semiconductor device (10) obtained by the method as recited in claim 1.

16. Apparatus for performing a method according to claim 1, characterized in that the apparatus comprises a deposition reactor and is provided with a first source for a gaseous compound of silicon which is free of chlorine and a second source for a gaseous compound of silicon which comprises chlorine.

17. Apparatus according to claim 16, characterized in that it is provided with a first carrier gas source comprising an inert gas and a second carrier gas source comprising hydrogen and with means to switch the carrier gas from the inert gas to hydrogen during the deposition process.

APPENDIX OF EVIDENCE

Appellant is unaware of any evidence submitted in this application pursuant to 37 C.F.R. §§ 1.130, 1.131, and 1.132.

APPENDIX OF RELATED PROCEEDINGS

As stated in Section II above, Appellant is unaware of any related appeals, interferences or judicial proceedings.